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19624 DOWNES ROAD
PARKTON, MARYLAND 21120

Telephone 410-329-6548

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WATER VAPOR CONDENSATION DAMAGE TO MANUFACTURED HOUSING

IN

THE HOT, HUMID CLIMATE OF THE SOUTHEASTERN UNITED STATES

MANUFACTURED HOME

OF

KELLY MURPHY
5489 WASHINGTON FERRY ROAD
MONTGOMERY, ALABAMA

For

Beasley, Allen, Crow, Methvin, Portis & Miles, P.C.
Mr. Lance Gould
218 Commerce Street
Montgomery, Alabama 36104

October 18, 2007

By


Dr. Robert L. Kondner, P.E.



INTRODUCTION

The hot, humid climate of the southeastern part of the United States requires careful consideration of potential moisture problem mitigation during the construction and siting of manufactured housing governed by the Department Of Housing And Urban Development (HUD) under 24CFR3280. The manufactured home of Kelly Murphy located at 5489 Washington Ferry Road, Montgomery, Alabama is located within the hot, humid and fringe climatic zone defined by HUD and, as such, subject to the conditions and regulations generated for such climatic locations.

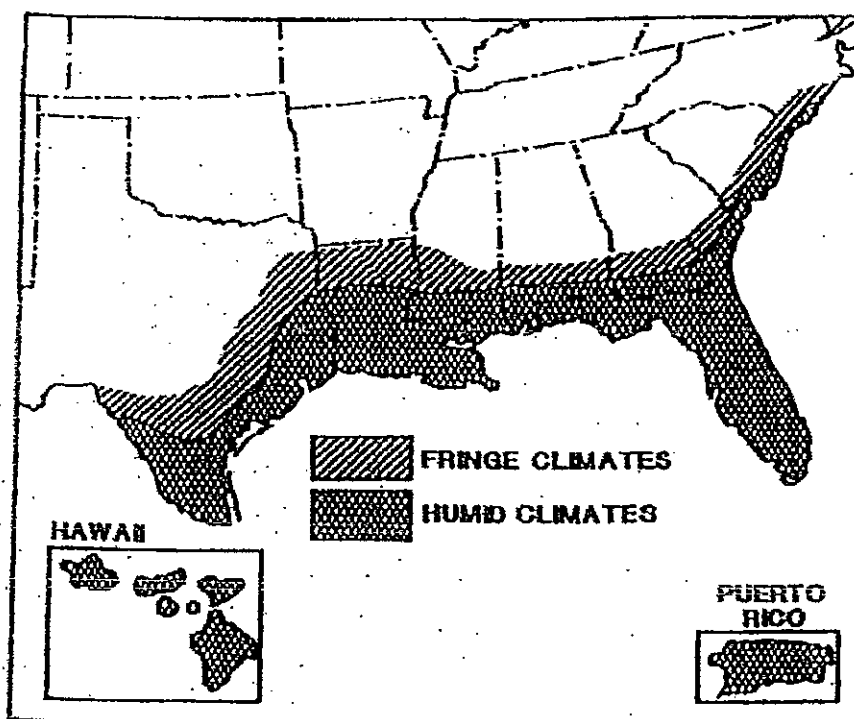
The manufactured home at 5489 Washington Ferry Road has been inspected by R. T. Bonney and Associates, Inc. and the results of that inspection are contained within their report dated July 5, 2006. In addition, the Kelly Murphy manufactured home also was inspected on May 22, 2006 for elevated moisture within the perimeter walls, mold growth and penetrations of the building envelope by Healthy Homes of Louisiana, L.L.C., the results of which are contained in their report.

CLIMATIC LOCATIONS

The geographic areas of the southeastern U.S. deemed to be within these hot, humid and fringe climatic conditions are shown in Figure 1 as expressed by HUD in the Federal Register, Vol. 67, No. 79, April 24, 2002. All or parts of Alabama, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, and Texas denoted by counties, are deemed by HUD to be within the hot, humid and fringe climatic conditions.

Humid and Fringe Climate Map

FIGURE 1



F. The following areas of local governments (counties or similar areas, unless otherwise specified), listed by State, are deemed to be within the humid and fringe climate areas shown on the Humid and Fringe Climate Map, and this waiver may be applied to homes built to be sited within these jurisdictions:

Alabama

Baldwin, Barbour, Bullock, Butler, Chocoma, Clarke, Coffee, Conecuh, Covington, Crenshaw, Dale, Escambia, Geneva, Henry, Houston, Lowndes,

Marengo, Mobile, Monroe, Montgomery, Pike, Washington, Wilcox.

Florida

All counties and locations within the State of Florida.

Georgia

Appling, Atkinson, Bacon, Baker, Ben Hill, Berrien, Brantley, Brooks, Bryan, Calhoun, Camden, Charlton, Chatham, Clay, Clinch, Coffee, Colquitt, Cook, Crisp, Decatur, Dougherty, Early, Echols, Effingham, Evans, Glynn, Wayne, Grady, Irwin, Jeff Davis, Lanier, Lee, Liberty, Long, Lowndes, McIntosh, Miller, Mitchell, Pierce, Quitman,

Randolph, Seminola, Tattnall, Terrell, Thomas, Tift, Turner, Ware, Worth

Louisiana

All counties and locations within the State of Louisiana.

Mississippi

Adams, Amite, Clairborne, Clarke, Copiah, Covington, Forrest, Franklin, George, Greene, Hancock, Harrison, Hinds, Issaquena, Jackson, Jasper, Jefferson, Jefferson Davis, Jones, Lamar, Lawrence, Lincoln, Pearl River, Perry, Pike, Rankin, Simpson, Smith, Stone, Walthall, Warren, Wayne, Wilkinson

North Carolina

Brunswick, Carteret, Columbus, New Hanover, Onslow, Pender

South Carolina

Jasper, Beaufort, Colleton, Dorchester, Charleston, Berkeley, Georgetown, Horry

Texas

Anderson, Angelina, Aransas, Atascosa, Austin, Bastrop, Bee, Bexar, Brazoria, Brazos, Brooks, Burleson, Caldwell, Calhoun, Cameron, Camp, Cass, Chambers, Cherokee, Colorado,

Comal, De Witt, Dimmit, Duval, Falls, Fayette, Fort Bend, Franklin, Freestone, Frio, Gavelston, Goliad, Gonzales, Gregg, Grimes, Guadalupe, Hardin, Harris, Harrison, Hays, Henderson, Hidalgo, Hopkins, Houston, Jackson, Jasper, Jefferson, Jim Hogg, Jim Wells, Karnes, Kaufman, Kennedy, Kinney, Kleberg, La Salle, Lavaca, Lee, Leon, Liberty, Limestone, Live Oak, Madison, Marion, Matagorda, Maverick, McMullen, Medina, Milam, Montgomery, Morris, Nacogdoches, Navarro, Newton, Nueces, Orange, Panoite, Polk, Rains, Refugio, Robertson,

Rusk, Sabine, San Angistine, San Jacinto, San Patricio, Shelby, Smith, Starr, Titus, Travis, Trinity, Tyler, Upshur, Uvalde, Val Verde, Van Zandt, Victoria, Walker, Waller, Washington, Webb, Wharton, Willacy, Williamson, Wilson, Wood, Zapata, Zavala

Dated: April 16, 2002.

John C. Weicker,

Assistant Secretary for Housing Federal Housing Commissioner.

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MANUFACTURED HOUSING PERFORMANCE IN HOT, HUMID CLIMATES

For years manufactured housing in the hot, humid climate of the southeastern part of the United States has suffered from water vapor condensation moisture problems caused by humid, hot, moisture -- laden outside air penetrating the exterior envelope of the home and coming into contact with cooler, less permeable interior surfaces such as vinyl wall or floor coverings, resulting in soft and deteriorating wallboards, extensive mold formation, buckled floors, damaged wood trim and molding, and health concerns that have prevented the manufactured housing from meeting the performance requirements of HUD 24CFR 3280.303(b) that "all construction methods shall be in conformance with accepted engineering practices to insure durable, livable, and safe housing and shall demonstrate acceptable workmanship reflecting journeyman quality of work of the various trades".

It is important to consider the relative permeability of various wall, ceiling, and floor products used in manufactured housing in the hot, humid, and fringe climates of the United States. For example, 3/8 inch gypsum wall board laminated with paper having a water based top coat had a measured permeability of 11.44 perms while the same wall board laminated with 4 mil vinyl had a measured permeability of 0.42 perms, a difference of 2724 percent, resulting in a nearly impermeable inside wall surface when vinyl is used as the exterior wall living space side covering. This virtually guarantees the condensation of water vapor on the backside of the vinyl covered surface within the exterior wall structure.

In response to the extensive history of complaints of the damages caused by these water vapor condensation moisture problems in hot, humid climates, HUD in March 2000 issued a waiver process for CFR 3280.504 "Condensation control and installation of vapor retarders." Prior to March 2000, CFR 3280.504 did not make a distinction among the various climatic conditions of the United States for water vapor condensation control and the construction installation of vapor retarders. The waiver process allows manufacturers of manufactured houses constructed to be sited

in hot, humid and fringe climates to install the vapor retarder on the exterior side, rather than the interior or living space side, of the exterior walls provided that the permeability of the exterior wall has a vapor retarder or exterior covering with a permeability not greater than 1.0 perm and the interior or living space side of the wall with a permeability of 5 perms or greater. The waiver also requires manufacturers to add a statement and a map to the data plate of the home stating that the house is only suitable for installation in humid and fringe climates.

Under 24 CFR 3282.14 "Alternative construction of manufactured homes", Section (a), HUD "encourages innovation and the use of new technology in manufactured homes" and "will permit manufacturers to utilize new designs or techniques not in compliance with the Standards" and "(2) Where such construction would provide performance that is equivalent to or superior to that required by the Standards." However, manufacturers using such waivers shall provide notice to prospective purchasers regarding the particulars of the waiver prior to actual purchase. When HUD issues a waiver, it reminds manufacturers that additional measures are likely needed in the design and construction of their homes to sufficiently abate the moisture problems in hot, humid climates and, therefore, comply with other requirements in the Standards, such as the performance requirements of CFR 3280.303(b) "to insure durable, livable, and safe housing".

Regardless of the waiver and alternative construction, the use of vinyl covered wallboard in hot humid climates has never been required for CFR 3280.504(b)(1). In fact, a vapor permeable wallboard has at all relevant times been available under CFR 3280.504(b)(1).

MANUFACTURER HOUSING DEFECTS IN HOT, HUMID CLIMATES

The most egregious defect of manufactured housing in the hot, humid, and fringe climates of the southeastern United States is the installation of vinyl covered wallboard as a vapor barrier or as a vapor retarder on the interior or living space side of the wall, ceiling, and floor areas of the home which are the colder inside surfaces. Such construction guarantees that humid, hot, moisture – laden outside air water vapor that penetrates the exterior envelope (walls, roof, underside belly board) of the home must condense to form water on the colder back surfaces of vinyl covered wallboard as the vapor barriers or as vapor retarders which are the back – side surfaces within the walls, above the ceilings, and below the floors. This condensation water within the walls, above the ceilings and below the floor cannot escape and builds up (accumulates) resulting in deterioration of the wall boards, deterioration of the ceiling support structures, deterioration of the floor support structures with buckled floors and damaged wood trim and floor moldings, as well as the formation of an environment for the formation and growth of various types of molds within the walls, ceiling, and beneath the floors. Such construction is a clear violation of 24 CFR 3280.303(b) because it is a direct violation of “accepted engineering practices” and is not in conformance with the performance requirements of providing and insuring “durable, livable, and safe housing.”

The second most egregious form of deficiency of manufactured housing in the hot, humid, and fringe climates of the southeastern U.S. is the sum package of individual point defects that allow the hot, humid, outside water vapor to penetrate the exterior building envelope. These individual point defects include; leaks and holes in the heating and cooling air ductwork systems with potential positive pressures in the belly and negative pressures within the living space drawing in outside water vapor air, failed return air ducts resulting in pulling of moist air from crawlspace, holes – tears in the belly board coverings below the floor system above the crawlspace with or without ground vapor

barriers and crawlspace skirt venting, improper sizing and operation of air conditioning systems, improper location and use of exhaust fans, electrical and plumbing pathways and devices acting as holes thru the building envelope, etc.

The above sum package of defects reflects on the quality of construction of manufactured housing and casts doubt that 24 CFR 3280.303(b) is being met since the above package of defects does not meet the performance requirements to insure "durable", livable, and safe housing and shall demonstrate "acceptable workmanship" reflecting "journeyman quality of work of the various trades."

EXAMPLE OF MANUFACTURED HOUSING IN HOT, HUMID CLIMATE

The double wide manufactured home located at 5489 Washington Ferry Road, Montgomery, Alabama, is one example of manufactured housing located within the hot, humid climate of the southeastern United States. Inspection reports prepared by Healthy Homes of Louisiana, LLC and R. T. Bonney and Associates, Inc. demonstrate that the home was constructed using vinyl covered wall board for the interior living space sides of the exterior walls resulting in water vapor condensation moisture accumulating inside the perimeter walls which has caused structural deterioration and created fungal (mold) growth within the wall structure. Such construction in direct violation of accepted engineering practice within the hot, humid climate of the southeastern United States will worsen with time and eventually render the home unfit for it's use as housing. This does not meet the performance requirements of 24 CFR 3280.303(b) and, thus the housing is not in compliance with the HUD Standards for manufactured housing.